Radiative Bhabhas in the IFR

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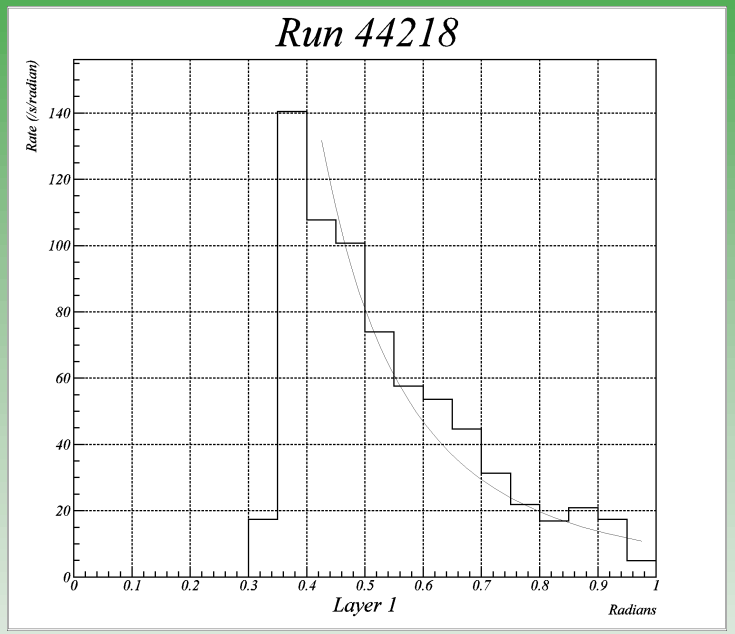
Software and Runs Used

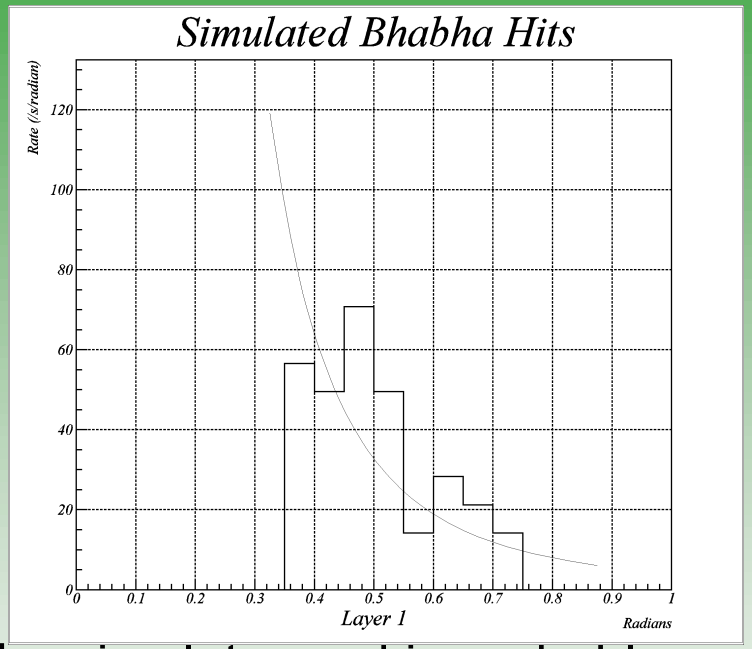
- Release: 15.7.1
- Package: PepBkgMon V00-00-02
- Simulation: Bhabha_generic_1deg.tcl
  - Uses Bhwide event generator
  - For angles greater than 1 degree in Bhabha rest frame
- Data: Run 44218 (January background run)

Predicted Bhabha rate

- The Born level differential cross section for Bhabhas is[1]: $d\sigma/d\Omega = \alpha^2/2s\ [(1+\cos^4\theta/2)/\sin^4\theta/2 - 2(\cos^4\theta/2 / \sin^2\theta/2) + (1+\cos^2\theta/2)/2]$
- For small angles, this is approximately $d\sigma/d\Omega = 32\pi\alpha^2/s\theta^3$, for a $1/\theta^3$ distribution
- Using $\alpha = 1/137$ and $s = 10.58^2$, $d\sigma/d\Omega = 18.6/\theta^3$ nb
- This gives a Bhabha rate of 29kHz for $\theta > 1^0$ at $10^{33}cm^2$

Data Cont.: Radial Plots





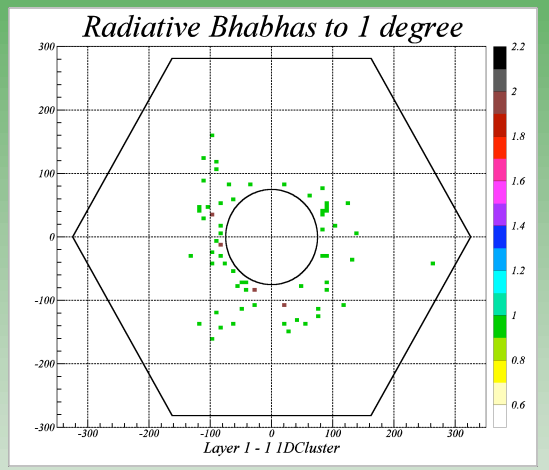
- Note: Bhwide is a wide angle Bhabha simulator and is probably inaccurate for angles less than 10 degrees
- No noise: with noise added the noise dominates the hits from the Bhabhas
- Simulation scaled assuming 29kHz rate
- Data: Rate=10.113/Theta^3 Chisq=2.084
- Simulation: Rate=5.383/Theta^3 Chisq=1.483

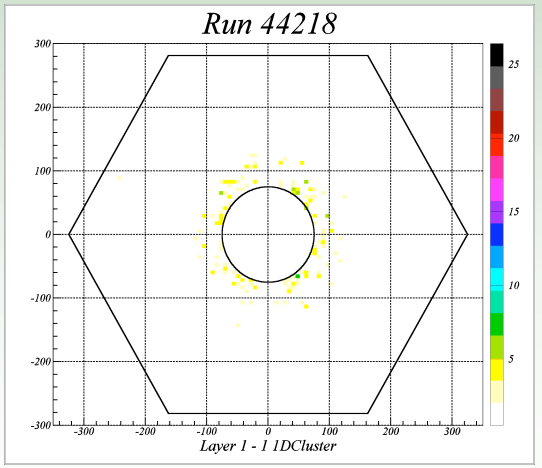
Neutron Calculation

- Using 1 neutron/5GeV (from Monday MDI meeting), .14 Amps/hour lost in each beam, 1-2 MeV neutrons, the predicted rate of interactions in the 2mm of gas in an IFR layer is roughly 94kHz.
- This is comparable to the noise rate in the IFR

Details and Conclusions

- Angular distribution of Bhabhas in the IFR looks reasonable
- Comparison with data consistent with significant backgrounds from Bhabhas





To Do

- Migrate to Release 16, PepBkgMon V00-01-17
- Produce more noiseless Bhabha MC
- Look into different event generators (Bhlumi, BbBrem, fix Bhwide small angle bug)
- Re-run simulation with extended detector model
- Start looking at predicted neutron rate from MC

Bibliography

1. Hep-ex 9910066v2

Homework Problem Details

- Beam loss: .2A each beam over 1.4 hours
- Turn Period: 7.336E-6 sec
- Beam Energies: LER 3.1, HER 9.0
- Neutron rate: 1/5GeV
- Cross Sections for 1-2 MeV neutrons:
  - C=1.8b, Ar=1.3b, F=2.7b, H=3.3b
- Gas: 65.5% Ar, 4.5% Isobutane, 30.0% Freon
- Intermediate Numbers:
- Beam loses 2.2E10GeV/s. Interaction Length=10.4g/cm^2=3940cm